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Spinning Oil For Producing Combed Sliver

The present application relates to the use of fatty acid methyl esters of vegetable origin as smoothers in lubricants for combed wool sliver production, a lubricant for combed sliver production and a process for lubricating wool in combed sliver production.

Worsted or combed yarn spinning is a way of producing high quality yarn from staple fibers. The staple fibers used are mainly wool and blends of wool with PES, PAN or other synthetic fibers. The yarns are processed as single or folded yarn into textile fabrics. Before the wool which is to be processed into worsted yarn is actually spun, it has to undergo an intensive washing operation to remove organic and inorganic impurities in order that trouble-free processing in spinning may be ensured. After washing, the wool is dried. The removal of fiber concomitants, especially wool wax and fats, alters the static and dynamic friction properties of the wool to a substantial extent, so that the further processing of the wool, especially under conditions of intensive fiber-fiber and fiber-metal friction, is extremely problematical.

The friction properties altered during the washing of the wool are distinctly ameliorated by lubricating the dried wool. The wool is then further processed by carding, i.e. the production of a fiber assembly from the pretreated staple fibers. It is especially during this processing stage that the wool fiber material is severely stressed by fiber-metal friction. This stress has the effect of reducing the mean staple length of the wool (hauteur). To counteract this staple shortening, the wool has to be treated with a suitable lubricant before carding. The wool which is present after carding as a card sliver or after combing as a combed sliver is then spun by repeated doubling,

drafting and subsequent ring spinning into a fine, regular yarn in the worsted-spinning process.

Lubricating is a key operation in combed sliver production, since an increased fraction of short fibers as a result of inadequate lubricating leads to a reduction in the yield of combed sliver and also to adverse effects on combed sliver strength, for example. These losses have appreciable economic repercussions. For instance, a yield improvement of just 0.3% for a typical large combed sliver producer having an annual output of 60 000 t of combed wool sliver will yield an additional 180 t of sales product. This amounts to increased profits of more than 1 million deutschmarks, depending on the prices at the time. World production of combed sliver amounts to about 1.5 million t a year. Accordingly there continues to be a demand for improved lubricants for combed sliver production.

Combed sliver production lubricants are generally used as aqueous emulsions of smoothers or as the neat products. Known smoothers apart from mineral oils include in particular fatty acid polyglycol esters and also pure fatty acid esters (cf. Handbuch der Textilhilfsmittel, A. Chwala, V. Anger, Weinheim 1997, pages 314 to 320 and "Die Bedeutung der Schmälze und der Avivage bei der Kammgarnherstellung", W. Becker, in textil praxis international, October 1990). These smoothers are customarily processed in combination with emulsifiers into a lubricant that is preferably applied to the wool fibers before carding.

Commonly assigned EP 587 601 B1 discloses that fatty acid methyl esters are useful lubricants in the production of woolen yarns. By way of example the document discloses the use of esters based on animal fatty acid mixtures, especially of tallow fatty acids, as smoothers in lubricants for woolen yarn spinning. Woolen yarn spinning, then, has different demands on the lubricant to combed sliver production because of the different further processing of the fibers. In both processes, the wool is carded in the first percent

[sic] step (after washing, dyeing, etc.), but both the machinery and the production goal are appreciably different in combed sliver production to woolen yarn spinning. Worsted yarns are spun from fine wools via a combed sliver as an intermediate stage. Woolen yarns, in contrast, are immediately spun after carding from the rovings produced on the woolen yarn card. The differences in the products are contrasted in the following table:

	Worsted yarn	**Woolen yarn**
Surface structure	smooth	rough, mossy
End use	fine outerwear yarns	coarse, robust outerwear yarns, carpet yarns
Yarn count	Nm 20-100 (fine)	Nm 0.5-20 (coarse)
Yarn regularity	high	relatively low

Nor did a use of the methyl esters based on - animal - tall oil fatty acids exemplarily disclosed in EP 587 601 B1 lead to an improvement in combed sliver production. But it was found that, surprisingly, the use of fatty acid methyl esters of selected fatty acid mixtures as smoothers leads to a distinct reduction in the fraction of short staple in the carding of wool fibers.

A first embodiment claimed is the use of C_{6-22}-fatty acid methyl esters of vegetable raw materials as smoothers in lubricants for the production of combed wool slivers.

The fatty acid methyl esters used according to the invention are commercially available products which are prepared by the well known esterification of the free fatty acid or by transesterification of fatty acid triglycerides with methanol, usually in the presence of acidic catalysts. The invention uses exclusively fatty acid methyl esters prepared by transesterification of the natural triglycerides from vegetable sources such as coconut oil, soybean oil, rapeseed oil, palm oil or

palm kernel oil. The as-prepared methyl esters may be used without further processing, after distillative processing or else after hydrogenation of the unsaturated fractions. Particular preference is given to the use of such fatty acid methyl esters as have been prepared on the basis of coconut fatty acids, palm kernel fatty acids, palm oil fatty acids and especially mixtures thereof.

As well as the smoothers from vegetable raw materials, it is preferable to use emulsifiers and further customary additives.

Coconut fatty acids predominantly include mixtures of lauric acid and myristic acid. Cocoa fatty acid typically includes 0.2 to 1% by weight of hexanoic acid, 5.4 to 8.0% by weight of octanoic acid, 6.5 to 8.5% by weight of decanoic acid, 45.0 to 51.0% by weight of lauric acid, 16.5 to 18.5% by weight of myristic acid, 9.0 to 10.5% by weight of palmitic acid, 2.0 to 2.3% by weight of stearic acid, 0.2 to 0..4% by weight of behenic acid and 8.0 to 10.0% by weight of oleic acid and also 0.7 to 1.0% by weight of linoleic acid.

Palm kernel fatty acids typically have the following composition: caproic, caprylic, capric acid 9% by weight, lauric acid 50% by weight, myristic acid 15% by weight, palmitic acid 7% by weight, stearic acid 2% by weight, oleic acid 15% by weight, linoleic acid 1% by weight.

Palm fatty acids typically have the following composition: myristic acid 2% by weight, palmitic acid 42% by weight, stearic acid 5% by weight, oleic acid 41% by weight and linoleic acid 10% by weight.

According to the invention, these methyl ester mixtures are used as smoothers in lubricants, the lubricants including 50 to 95% by weight, especially 60 to 80% by weight, of the above-described fatty acid methyl esters.

This application accordingly further provides lubricants for combed sliver production, including

a) 60 to 80% by weight of C_{6-22} fatty acid methyl esters of vegetable raw materials as smoothers

b) 5 to 30% by weight of emulsifiers

c) 0 to 10% by weight of additives

The lubricants of the invention preferably include as smoothers fatty acid methyl esters based on coconut fatty acid, palm kernel fatty acid or palm oil fatty acids and mixtures thereof. Preference is given to lubricants that include exclusively methyl esters based on coconut fatty acid or palm kernel fatty acid. But it is also preferable to use mixtures of methyl esters based on coconut fatty acid, palm kernel fatty acid or palm oil fatty acids, preference being given in particular to such mixtures where the three different methyl esters are present in an amount ratio of 1:1:1.

Useful additives for inclusion in the lubricants of the invention are corrosion inhibitors, antistats, adhesion promoters, bactericides, antioxidants, pH regulators and viscosity improvers.

Useful emulsifiers include nonionic, anionic and cationic emulsifiers, for example partial esters of di- and/or triglycerol, such as triglyceryl monooleate, alkoxylated, preferably ethoxylated and/or propoxylated, fats, oils, C_{8-22} fatty acids, C_{8-22} fatty alcohols and/or C_{8-22} fatty acid mono- and/or diethanolamides, such as optionally ethoxylated oleic acid mono- or diethanolamide, alkoxylated, preferably ethoxylated, C_{8-22} fatty acids whose OH group is replaced by a C_{1-4} alkoxy group, alkali metal and/or ammonium salts of C_{8-22} alkylsulfonates, alkali metal and/or ammonium salts of C_{8-22} alkylsulfosuccinates, such as sodium dioctylsulfosuccinate, and/or amine oxides, such as dimethyldodecylamine oxide.

The viscosity of the lubricant may in principle be raised using triglycerides such as the relatively highly viscous rapeseed oil or polymeric compounds. German Patent DE 39 36 975 discloses coning oils containing fatty acid alcohol polymethacrylates to control sling-off. German Offenlegungsschrift

DE 39 24 160 discloses additives comprising carboxyl-free homo- and/or interpolymers of esters of acrylic acid and/or methacrylic acid having limiting viscosities [η] of less than 300, preferably 800, ml g^{-1}, measured at 20°C in tetrahydrofuran. The reported limiting viscosities [η] are customary in the art and are described for example in Vollmert, "Grundriß der Makromolekularen Chemie", Volume III, pages 55 to 61, VErlag E. Vollmert, Karlsruhe 1982. Owing to their high limiting viscosity, the additives described improve the fiber-drawing and/or adhesive performance of oils and/or fats.

The lubricants of the invention are prepared in a conventional manner by mixing the stated constituents in the stated amounts with each other in any order at temperatures between 18 and 25°C.

Lubricants may be used neat or preferably in the form of aqueous emulsions. This application further provides a process for lubricating wool in combed sliver production, wherein the wool is treated with an aqueous emulsion including an active ingredient content - based on the weight of the wool - of 0.25 to 0.60% by weight of lubricant as per the above description before carding. The textile fibers are present as staple.

Examples

Two inventive carding lubricants which contain fatty acid methyl esters of vegetable raw materials were tested. The lubricants were prepared by simply stirring the raw materials together. The washed wool for the tests was half lubricated with a standard textile auxiliary based on tallow fatty acid methyl ester. The rest of the wool staple was finished with the product of the invention. Product was applied in each case at 0.5% on weight of wool.

The wool was subsequently carded, drawn out, combed and drafted, and the combed sliver yield of the product (B) lubricated according to the invention

compared with the yield of a combed sliver (A) produced in standard fashion. The values mentioned under A and B constitute the weight difference calculated according to the formula:

$$\text{Yield (\%)} = \frac{\textit{combed sliver weight [kg]} \times 100}{\textit{washed staple weight [kg]}}$$

between washed staple weight and ready-produced combed sliver. The yield improvement in % represents the improvement in yields of combed sliver (difference A, B) produced using the product prepared according to the invention. It can be seen that the lubricants of the invention provide a higher yield of finished products than obtained on using existing products based on animal fatty acid esters.

Table 1: Composition of lubricants according to the invention:

Example	Amounts [in % by weight]	Ingredients
1	58.00	Coconut/palm kernel/palm oil fatty acid methyl ester
	12.00	Coconut fatty acid diethanolamide
	10.00	Coconut fatty acid polyglycol ester
	5.00	EO/PO-polyglycol, molar mass: 2 500
	5.00	Sodium alkanesulfonate
	10.00	Water
2	80.00	Coconut/palm kernel/palm oil fatty acid methyl ester
	10.00	Coconut fatty alcohol + 5 EO
	5.00	Sodium alkanesulfonate
	5.00	Diethanolamine

Table 2: Results of application tests:

		Finished product amount in % of raw material used		
	Application amount in %	Test 1	Test 2	Test 3
Wool quality (length mm/diameter μ)		64/21	68/21.6	72.2/21.8
A	0.5	88.68	90.16	88.70
B	0.5	90.64	90.70	89.70
Yield improvement in %		**1.96**	**0.54**	**1.00**